INDIA WEATHER REVIEW, 1966

ANNUAL SUMMARY

PART-C

STORMS & DEPRESSIONS

Depressions and cyclonic storms.

During the year, 7 cyclonic storms and 9 depressions formed in the Bay of Bengal and 1 cyclonic storm and 1 depression formed in the Arabian Sea. Two of the cyclonic storms from the Bay of Bengal emerged into the Arabian Sea as depressions and intensified into cyclonic storms. One cyclonic storm from the Bay of Bengal emerged into the Arabian Sea as a depression. The tracks of the storms and depressions are given in Fig. 1. The dates of activity of the storms and the greatest barometric depths observed (or estimated) near their centres are summarised in the following table :-

Table I

Locality	Month	Date	Greatest observed (or estimated) barometric depth (mb)
Bay of Bengal	April - May	28 - 4	20
Bay of Bengal	Sept - Oct.	27 - 1	20
Arabian Sea	Sept. - Oct.	29 - 5	15
Bay of Bengal	November	1 - 11	52
Bay of Bengal	- do -	8 - 14	22
Bay of Bengal	- do -	18 - 22	25
Bay of Bengal	- do -	25 - 30	19
Bay of Bengal	December	7 - 13	22

The monthly distribution of the storms and depressions for the year is given in Table II at the end. The detailed descriptions of the systems are given below.

1. Severe cyclonic storm in the Bay of Bengal - 28 April to 4 May.

On the 27th April, the following ships observations were received :

National Oceanic and Atmospheric Administration

Environmental Data Rescue Program

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September 14, 1999

INDIA WEATHER REVIEW, 1966.

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

CONTENTS

I Depressions and Cyclonic Storms C 1 - C 24

Name of the ship	Time IST	Position Lat. °N	Position Long. °E	Wind Direction	Wind Speed knots	Pressure (mb)	Weather
VWKW	1030	10.0	91.4	ESE	10	1009.8	-
JHWS	1130	3.3	90.9	250	31	1010.0	Raining
MCLD	1130	6.0	88.5	040	14	1009.0	- do -

These observations indicated that a low pressure area lay over the south-east Bay and adjoining south Andaman Sea on the afternoon of 27th April. On the morning of 28th all the Bay Island stations reported rain as present weather. At 0530 hrs IST, Ship PHTL (6°.0 N; 92°.6 E) reported wind 190/16 Kt and pressure 1005.2 mb and ship MCLD (6°.1 N; 84°.4 E) wind 300/20 kt and pressure 1006.3 mb and Car Nicobar observatory reported at 0830 hrs IST light southerly wind and pressure 1008.0 mb. These observations along with three closed isobars over the area suggested that the low pressure area has concentrated into a depression with centre at 0830 hrs IST of 28th near Lat. 8° N; Long 93° E. It moved westnorthwestwards and lay at 1730 hrs IST of the same day with centre near 8°.5 N; 86°.5 E. Ship S.S. Freinfels (DEDP) at 10°.3 N 84°.4 E reported at 0830 hrs IST of 29th wind NNW/30 kt and pressure 998.9 mb indicating that the depression moved northwestwards and intensified into a deep depressio centred at 0830 hrs IST of 29th within half a degree of 10°.5 N; 85°.0 E. At 1730 hrs. IST SS Jalaganga (VWBJ) at 10°.4 N; 83°.6 E reported wind 340/36 kt. The deep depression thus intensified into a cyclonic storm over the southwest Bay centred at 1730 hrs. IST of 29th within half a degree of 11°.0 N; 85°.0 E. The other relevant ship is VWPS 13°.6 N; 85°.9 E reporting pressure 1003.4 and wind eastsoutheasterly 25 kt. Moving westnorthwestwards, the storm intensified into a severe cyclonic storm with a core of hurricane winds and was centred at 0830 hrs. IST of 30th within half a degree of 11°.5 N; 84°.0 E and at 1730 hrs. IST of the same day within half a degree of 12° N; 82° E. The following ships' observations are relevant in this connection :-

Name of the ship	Time IST	Position Lat. °N	Position Long. °E	Wind Direction	Wind Speed knots	Pressure (mb)	Weather
SS Jalaganga	0530	12.6	84.6	110	37	996.7	-
SS Clanfarquharson	0730	11.1	85.5	220	24	1007.3	-
SS Werneelen Bincer	1330	11.3	82.7	250	35	999.2	Passed storm centre at 1220 IST in Lat. 11°.3 N Long. 82°.7 E. At 1330 hrs IST winds WSW Force 8
SNPM	1000	11.4	80.4	NE	35		Swell NNE

It lay close to Madras coast near Lat. 12°.0 N; 80°.5 E at 0130 hrs IST of 1st May and crossed north Madras coast near 12°.0 N by 0530 hrs IST of the same morning. It thereafter, weakened into a deep depression centred at 0830 hrs IST of 1st near Cuddalore. Moving westwards and weakening, it was centred as a depression over Salem at 1730 hrs IST. Moving northwestwards, it was centred near Chitradurga on the morning of the 2nd and between Miraj and Vengurla at 0830 hrs IST of 3rd. It

continued to move northwestwards upto 17°N, recurved towards northeast later and was centred at 1730 hrs IST of 3rd about 100 km south of Pooma. It lay at 0830 hrs IST of 4th between Baramati and Jeur. The depression then moved eastnortheastwards and weakened into a low pressure area. Weakening further the system continued to move eastnortheastwards as an upper air trough to West Bengal where it became unimportant by the 10th.

Under the influence of the disturbance, widespread rainfall with a number of heavy to very heavy falls occurred over the Peninsula. The rainfall belt also extended to the central parts of the country. Cuddalore recorded an exceptionally heavy fall of 35 cm of rain on 1st May. Other noteworthy amounts of rainfall recorded were : Kallakkurichchi 10 cm and Madras 9 cm on 1st May; Palghat 10 cm and Bangalore and Hassan 9 cm each on 2nd; Honavar 19 cm, Panjim (Goa) 15 cm, Dabholim (Goa) 14 cm, Karwar 11 cm and Kolhapur 10 cm on 3rd May and Marmagoa 10 cm and Miraj 9 cm on 4th.

2. Depression in the Bay of Bengal - 17 to 18 May.

A trough of low formed over Andaman Sea on the morning of 16th and was extending upto 500 mb. A low pressure area formed over north Andaman Sea by the evening. By the next morning (i.e. 17th), it concentrated into a depression and was centred near 14°N; 96°E. A ship of call sign WYBY at 11°.8 N and 95°E reported SSWly wind of 20 kt at 0530 hrs IST. The upper air circulation was marked upto 850 mb but data at higher levels were not available. It moved northwestwards and by the next morning (18th) lay near 17°N; 93°E. It weakened in situ into a low pressure area by the evening.

3. Depression in the Bay of Bengal - 2 to 3 June.

A well marked trough of low pressure extending from north Andaman Sea to west central Bay was noticed on the morning of 1st June. Upper air trough was noticed over the region upto 500 mb. By the next morning the low was more marked and lay over west central and adjoining east central and north Bay. Cyclonic circulation was noticeable upto 500 mb. At 1130 hrs IST of 2nd, the upper air cyclonic circulation was more marked, Coco Island reporting 25/40 knots of wind between 0.3 km and 0.9 km a.s.l. No Ships' data were available in the region. However, from the wind field and isobaric configuration, it would appear that the low has concentrated into a depression centred at 1730 hrs IST of 2nd near 15°.0 N; 88°.0 E. By the morning of 3rd some data were available in the field of the system. The system which was by this time a deep depression, lay centred near 17°N; 85°.5 E. A ship at 14°.7 N; 85°.5 E, reported westerly wind of 20 kt and Kalingapatam reported a pressure of 999.6 mb and a wind of ENE/10 kt. At 0.9 km a.s.l. Vishakhapatnam reported northerly wind of 35 kt. The upper air circulation was very marked. It moved northwestwards and crossed north Andhra coast near Kalingapatam by the evening of 3rd and rapidly weakened into a trough of low pressure over Andhra Pradesh by 4th morning.

There was good thundershower activity over Andhra Pradesh and Orissa on 2nd and 3rd.

The estimated lowest central pressure was 997 mb and the corresponding departure from normal minus 5 mb at 0830 hrs IST of 3rd.

4. Depression in the Bay of Bengal - 16 to 18 June.

By the morning of 14th, the monsoon trough shifted into northeast and adjoining east central Bay of Bengal upto 600 mb. Akyab reported eastsoutheasterly wind of 15 kt at 0.9 km a.s.l. A low pressure area formed over the northeast Bay and adjoining east central Bay by the morning of 15th. Upper air cyclonic circulation extending to 500 mb was present over north Bay and neighbourhood.

The low pressure area moved into north Bay by 15th evening and concentrated into a depression by the 16th morning with centre at 0830 hrs IST within half a degree of 21°N; 90°E. The associated upper air cyclonic circulation was well marked. At 0.9 km a.s.l., Calcutta reported northerly wind of 20 kt and Cox Bazar SSEly wind of 20 kt. At 1730 hrs IST of 16th, the depression was centred close to coast near 21°.5 N; 89°.5 E . It moved northwards, crossed West Bengal - East Pakistan coast by early morning of 17th and was centred at 0830 hrs IST between Khulna and Barisal. It then moved eastnortheast and was centred near Comilla at 1730 hrs IST of the same day. Moving eastnortheast it lay over south Assam with centre at 0830 hrs IST of 18th, about 80 km south of Silchar. Thereafter, it broke up against Assam hills by the 19th morning.

Under its influence, the southwest monsoon advanced into Bihar Plateau. There was fairly widespread rainfall activity in Orissa, Gangetic West Bengal, East Pakistan and Assam. Some of the noteworthy amounts of rainfall were : Sandheads 9 cm on 16th, Calcutta 7 cm on 17th, Agartala 13 cm, Keonjhargarh 7 cm on 18th and Kohima 10 cm and Imphal 8 cm on 19th.

The estimated lowest central pressure during the life of the disturbance was 994 mb and corresponding departure from normal was minus 5 mb at 1730 hrs IST of 16th.

5. Depression in the Bay of Bengal - 28 to 29 June.

A low pressure area with associated cyclonic circulation extending to 5.6 km was lingering over the Gangetic West Bengal and neighbourhood from the 20th to 26th June. On the morning of 27th, it shifted to the northwest angle Bay and adjoining land areas and became more marked. The cyclonic circulation in the upper air on 27th extended upto 7.0 km a.s.l. In a general negative pressure departure area, a concentrated area of negative pressure departure was noticed over there. By the next morning, the low pressure area concentrated into a depression over the northwest Bay which lay centred at 0830 hrs IST of 28th near 21°.5 N; 88°.0 E. The only significant observation available in this connection is of Sandheads which reported at 0830 hrs IST a southwesterly wind of 25 kt with continuous rain and a pressure of 993.8 mb. Moving northwards during the course of the day, the depression crossed West Bengal coast near 88°.5 E by the same evening and lay in the evening over Gangetic West Bengal and adjoining East Pakistan with centre at 1730 hrs IST near Krishnanagar. Continuing to move northwards during the course of the night, it was centred about 50 km northwest of Berhampore in the morning of 29th. Thereafter, it weakened and took a northwesterly course and lay in the evening of 29th as a low pressure area over central parts of West Bengal and adjoining Bihar State. By the next morning, the system became unimportant. The estimated lowest pressure and the corresponding departure from normal were 993 mb and -7 mb respectively on 28th at 0830 hrs IST.

Under its influence, monsoon was active in Orissa on 28th, in West Bengal on 29th June to 1st July and in Bihar Plains on 30th.

The noteworthy amounts of rainfall are : Balasore 9 cm on 28th, Calcutta (Dum Dum) 8 cm on 29th, Kalimpong 10 cm, Balurghat and Krishnanagar 9 cm each on 30th and Baghdogra 25 cm, Kalimpong 11 cm, Jalpaiguri 10 cm and Cooch Behar 8 cm on 1st July.

6. Depression in the Bay of Bengal - 16 to 18 July.

The formation of low pressure area over the north Bay of Bengal was noticed on the sea level chart on the morning of 15th. The upper air cyclonic circulation was extending upto 3.0 km a.s.l. Though there was a general fall of pressure over Burma, East Pakistan and the whole of north India and adjoining Peninsula, there was a more concentrated fall of pressure over north Bay and adjoining coastal areas. By the next morning, the low pressure area became well marked with upper air cyclonic circulation extending upto 5.0 km a.s.l. A concentrated area of negative pressure departures was observed over the area. By the same evening, the concentrated area of negative pressure departures became more marked and at 1730 hrs IST, the low concentrated into a depression and lay centred near 20°N; 88°E at 1730 hrs IST of 16th. Sandheads reported surface wind of ESEly 15 kt at 0.9 km a.s.l., easterlies to the north of the circulation were 15-20 kt strong. Circulation was extending to 9.0 km a.s.l. Puri recorded a rainfall of 16 cm from 0830 hrs IST to 1730 hrs IST of 16th. The depression remained practically stationary till the next morning.

The following observations of 17th are significant in this connection :

Name of the ship/ station	Time IST	Position		Wind		Pressure (mb)	Weather
		Lat. °N	Long. °E	Direction	Speed knots		
S.S. Jalavihar	0530	18.0	86.7	SW	25	995.9	Overcast sky
Sandheads	0830			ESE	10	994.3	-
Sagar Island	0830			NE	20	995.0	-

At 1130 hrs IST, SS Cardiff City (16°.7 N; 86°.4 E) reported westerly wind of 30 knots and light intermittent drizzle. Moving slowly westwards in the course of the day without further intensification, the depression was centred at 1730 hrs IST of 17th near 20°.0 N; 87°.5 E. In this connection, the following observations of 17th are worth mentioning :

Name of the ship/ station	Time IST	Position		Wind		Pressure (mb)	Weather
		Lat. °N	Long. °E	Direction	Speed knots		
Sandheads	1730			SE	15	991.9	-
Cardiff City	1730	17.6	87.0	W	25	994.7	Overcast

Continuing to move westwards in course of the night, the depression crossed north Orissa coast near Paradeep and was centred at 0830 IST of 18th about 30 km south-east of Cuttack. Thereafter it weakened into a low pressure area and moving west-northwest, it lay in the morning of 19th over the central parts of Madhya Pradesh and on 20th over Gujarat region and neighbourhood. Thereafter, it merged into the seasonal trough of low over West Pakistan by 21st.

The estimated lowest pressure and the corresponding departure from normal during the entire life period of the depression was 990 mb and -8 mb on 17.7.66 at 1730 hrs IST. The noteworthy amounts of rainfall are Puri 17 cm on 17th, Bolangir, 11 cm on 18th, Bhira 15 cm, Seoni 8 cm on 19th and Bhira 18 cm on 20th. /Gondia,

7. Depression in the Bay of Bengal, 28th - 31st July.

A well marked low pressure area formed over the northwest angle Bay on the morning of 27th. The upper air cyclonic circulation associated with the low pressure area extended upto 6.0 km a.s.l. The pressure over northeast India and adjoining areas was falling while a rise of pressure was noticed over the Peninsula and central parts of Madhya Pradesh. The pressure was below normal practically over the whole country outside southern parts of the Peninsula with an area of concentrated negative pressure departure over the north Bay and neighbourhood. By the next morning, the well marked low pressure area concentrated into a depression over the northwest angle of the Bay, whose centre at 0830 hrs IST of 28th was near 21°N; 89°E. The associated cyclonic circulation extended to 9 km a.s.l. Moving slowly northwestwards during the next 24 hrs, the depression lay on the morning of 29th close to coast centred at 0830 hrs IST near 21°.5 N; 87°.5 E. At 0530 hrs IST, Sandheads recorded a westsouthwesterly wind of 30 kt and at 0830 hrs IST SSWly wind of 25 kt. The ship S.S. Bharat Kesari (20°.1 N; 87°.5 E) reported a southsouthwesterly wind of 24 kt. The system caused widespread rain in Orissa and adjoining areas of Gangetic West Bengal. Chandbali recorded 11 cm of rain during 24 hours ending at 0830 hrs IST of 29th. Moving in a westnorthwesterly direction, the depression crossed coast between Balasore and Contai by the forenoon and lay over Bihar Plateau and neighbourhood with centre at 1730 hrs IST about 50 km southsoutheast of Chaibasa. Continuing to move in the same direction, it lay in the morning of 30th over northeast Madhya Pradesh centred at 0830 hrs IST near Ambikapur and about 60 km south of Sidhi at 1730 hrs IST. It was lying with centre about 100 km north of Jabalpur at 0830 hrs IST of 31st. Later it weakened into a low pressure area and merged with the seasonal low by 2nd August.

The estimated lowest pressure and the corresponding departure from normal during the entire life period of the depression were 988 mb and -10 mb respectively on 29th at 1730 hrs IST.

Under its influence, monsoon was active in Orissa on 29th and 30th and in Madhya Pradesh from 30th July to 1st August and in Uttar Pradesh on 2nd.

The noteworthy amounts of rainfall are : Chandbali 11 cm on 29th, Sagar 18 cm, Pachmarhi 15 cm on 31st, Pachmarhi 10 cm on 1st August and Gawlior 14 cm on 2nd.

8. Depression in the Bay of Bengal - 2nd to 8th September.

On the morning of first, the seasonal trough of low pressure extended into the northwest Bay. Widespread rain was reported from Chittagong-Arakan coast, Sandoway recording 19 cm of rainfall during 24 hours ending 0830 hrs IST of 1st. A general fall of pressure was noticed over the region extending from Arakan coast to Uttar Pradesh. By the next morning, a well marked low pressure area formed over the north Bay of Bengal with upper air cyclonic circulation extending upto 6.0 km a.s.l. Fall of pressure was more marked over the area and a concentrated area of negative pressure departure was noticed over there. Widespread rain was reported from the stations over coastal areas of Orissa and of West Bengal while there was a decrease of rainfall activity over the Arakan coast. By the same evening, the well marked low concentrated into a depression over the northwest Bay whose centre at 1730 hrs IST of 2nd was near 19°.5N; 88°E. In this connection, the following observations of 2nd are relevant.

Name of the station	Time IST	Position		Wind		Pressure (mb)	Weather
		Lat. °N	Long. °E	Direction	Speed knots		
Sandheads	1730			E	5	996.1	-
Sagar Island	1730			ENE	15	996.9	Drizzle
Chandbali	1730			NNE	5	997.4	Overcast sky

Moving westwards in the course of the night without intensification, the depression lay in the morning of 3rd close to Orissa coast with its centre at 0830 hrs IST of 3rd near 19°.5 N; 87°E. In this connection, the following observations of 3rd are significant:

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Wind Direction	Wind Speed knots	Pressure (mb)	Weather
S.S. Saudi	0530	19.8	89.5	S	20	998.0	Overcast sky
Sandheads	0830			SSE	10	997.5	-
Chandbali	0830			ESE	10	997.9	Intermittent moderate rain
Puri	0830			N	5	996.5	Continuous moderate drizzle

It caused widespread rain in Orissa and Gangetic West Bengal on 2nd - 3rd, Puri recording 10 cm and Chandbali 8 cm during 24 hrs ending 0830 hrs of 3rd. Continuing to move westwards, the depression crossed Orissa coast near Puri by the same evening and lay over Orissa with its centre at 1730 hrs IST about 50 km west of Bhubaneshwar. During the night, the depression remained practically stationary with little change in intensity. Thereafter moving westwards, the depression lay in the evening of 4th over southeast Madhya Pradesh with its centre at 0830 hrs IST, about 100 km eastnortheast of Kanker. [illegible]. Thereafter, it moved westnorthwestwards and lay in the morning of 5th over Vidarbha and adjoining southeast Madhya Pradesh with its centre at 0830 hrs IST about 50 km west of Kanker. It then took a northwesterly direction and lay in the evening of 5th over west Madhya Pradesh and adjoining Vidarbha with its centre about 50 km north of Nagpur. It was centred close to Hoshangabad on the morning of 6th. Continuing to move northwestwards, it lay over west Madhya Pradesh and adjoining east Rajasthan with centre at 0830 hrs IST of 7th near Nimach. It was centred about 50 km southeast of Jodhpur on the same evening. Thereafter, it recurved northnortheastwards, and lay in the morning of 8th over Rajasthan with its centre at 0830 hrs IST near Nagaur. Moving northnortheastwards it broke up over the Western Himalayas by 9th. The estimated lowest pressure and the corresponding departure from normal during the entire life period of the depression was 994 mb and -10 mb respectively on 3.9.66 at 0830 hrs IST.

Under its influence, there was a general revival of monsoon activity over the country which was maintained till 10th. The monsoon was particularly active over the central parts of the country and northwest India.

According to press reports, the flood waters of the Jhelum caused breaches of its embankments and inundated nearly 50 villages in Srinagar valley. The air service between Srinagar and Delhi remained suspended for three days due to bad weather and the Srinagar-Jammu road remained closed for traffic for about a week due to breaches.

Noteworthy amounts of rainfall recorded are : Puri 10 cm on 3rd, Jagdalpur 12 cm and Chandrapur 10 cm on 4th, Nizamabad 13 cm, Ramgundam 12 cm, Nander 10 cm on 5th. Khandala 10 cm on 6th, Bhilwara 24 cm and Surat 10 cm on 7th, Abu 24 cm, Deesa 21 cm, Ahmedabad and Dalhousie 14 cm each on 8th, Dharmsala and Dras 18 cm each, Jammu and Quazigund 17 cm each on 9th.

9. Severe cyclonic storm in the Bay of Bengal - 27th September to 1 October.

A low pressure area lay over southeast Bay of Bengal on the morning of 26 September. By the next morning it concentrated into a depression with probable centre near 9.5°N, 90.0°E. The westerly current to the south had strengthened. The following ships observations of 27th are relevant.

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
PCAG	0530	5.8	89.7	1005.8	WSW	25	Overcast
PCPN	0530	5.4	90.5	1006.3	WSW	25	Rain in past hour
PCPN	1130	5.5	91.3	1007.9	W	30	Shower
PCAG	1130	5.6	88.8	1006.5	WSW	30	Overcast
Port Blair (Surface)	0830			1008.9	E	15	Rain
Port Blair (at 2000')	0530				ESE	25	

APT pictures of date showed overcast heavy clouding to west, south and southeast of centre.

Moving northnorthwestwards, it became deep during night and lay centred near 12.5°N, 89.5°E by the morning of 28th. The following ships' observations are relevant in this connection.

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
GHRK	(28) 0830	11.0	90.0	1004.8	250	35	-
VWKW	(28) 0230	12.0	90.3	1002.6	230	20	Rain
VWPS	(27) 2330	12.5	91.0	1006.5	150	20	Rain
Port Blair (at 3000')	(28) 0530				250	40	

Another low was lying over west central Bay with central region near 12.5°N, 84.5°E.

APT pictures of date showed overcast heavy clouding in the region of the deep depression and also in the region of the low. By the next morning (29th), probably the deep depression and the low merged together. The system intensified into a cyclonic storm and was centred at 0830 hrs IST of 29th near 15.0°N and 85.5°E. Ship VWVI at 15.8°N, 85.5°E reported northnortheasterly wind of 30 knots and pressure of 1005.5 m at 0830 hrs IST and ship VWCY near 14.7°N, 85.3°E reported southsouthwesterly wind of 30 knots and a pressure of 998.3 mb and thunderstorm at 0530 hrs IST. By the evening, the cyclonic storm started recurving towards northeast and was centred near 15.5°N, 85.5°E. At 1730 hrs IST ship TMQZ near 15.7°N, 85.7°E reported a pressure of 992 mb an a wind of northnortheasterly 25 knots and the ship VWCY near 16.3°N and 85.8°E reported a pressure of 995.1 mb and wind of NNE 25 knots. Ship TMQZ also reported "force 6 wind from northeast and north, sea rough and swell northeasterly moderate, sky overcast,

rain squalls".

By the morning of 30th, the storm moved northnortheastwards became severe and lay centred at 0830 hrs IST of 30th near 17°N, 87.5°E. Ship VWCY near 17.2°N, 86.3°E reported a pressure of 994 mb and northerly wind of 25 knots at 0530 hrs IST. Ship Ocean Builder at 0800 hrs IST at 19.0°N, 86.7°E reported wind northerly force 8, heavy sea and swell, thick rain overcast, typical cyclone fringe weather, pressure 990 mb. At 1200 hrs IST Ocean Builder near 18.4°N, 86.0°E reported northnorthwesterly wind of force 9, heavy sea and swell. APT pictures of date showed central overcast and a large cloud band curving out from north to southeast of the central overcast. By the evening, the severe cyclonic storm had rapidly moved northnortheastwards and lay near 20.5°N, 88.5°E. Ship Jagjivan near 20.8°N, 88.3°E reported eastnortheasterly wind of 45 knots and pressure 993.4 mb and heavy continuous rain. Other relevant reports are :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWCY	1730	18.6	86.8	993.6	WNW	30	Drizzle
Sandheads	1730			991.6	NE	45	Squall

The severe cyclonic storm continuing to move rapidly northnortheastwards, crossed East Pakistan and West Bengal coasts by the morning of 1st October near 89.6°E and lay centred at 0830 hrs IST of 1st October about 50 km southeast of Dacca. It weakened into a deep depression and was centred about 50 km southeast of Silchar the same evening. Later it moved northnortheastwards and broke up against the Assam hills by the next day.

This system caused widespread rain with isolated heavy falls in Bay Islands on 28th September. Nancowry recorded 11 cm of rain and Port Blair 7 cm on 28th. Fairly widespread rain occurred in Assam from 1st to 3rd October and in Gangetic West Bengal on 1st October with some heavy falls over these areas. Sagar Island reported 11 cm on 1st October, Shillong 13 cm, Kohima 12 cm, Silchar 11 cm and Pasighat 10 cm on 2nd and Tura 11 cm on 3rd. According to press reports, there was heavy damage to life and property in the coastal districts of East Pakistan and the off shore islands due to the cyclone and tidal waves associated with it.

10. Cyclonic storm in Arabian Sea - 29 Sept to 5 October.

A trough of low pressure was persisting over east Arabian Sea off Mysore-north Kerala coasts since 25th. An upper air cyclonic circulation between 700-500 mb moved across south Peninsula on 26th. Under its influence, a well marked low formed off Mysore coast on the morning of 27th. The upper air cyclonic circulation was well marked upto 5.0 km a.s.l. The system concentrated into a depression by 0830 hrs IST of 29th and was centred near 12.5°N, 72.5°E. The depression remained more or less stationary (within half a degree) till the next day. Ship PJKA located at 10.2°N, 71.5°E reported at 2330 hrs IST of 30th a wind of 270°/27 kt. Amini reported at 0530 hrs IST of 1st surface wind of 270°/35 kt. and 270°/38 kt at 0830 hrs IST. Satellite picture at 1155 hrs IST showed a well marked vortex with good banding and cirrus outflow all around. The circulation was extending upto 6 km a.s.l. Pressure departures of 6 to 7 mb were reported from Arabian Sea Islands and stations along north Kerala-Mysore coasts. The depression intensified into a cyclonic storm by 0830 hrs IST of 1st October when it was centred at 12.5°N, 73.0°E. Ship PIOG located at 13.1°N, 73.6°E reported a surface wind of 100°/27 kt at 1130 hrs IST. Another ship JCGI reported at 1730 hrs IST a wind of 210°/30 kt near 12.2°N, 74.2°E. The system was of a small extent. The upper air cyclonic circulation was very well marked. At 0.6 km, Mangalore reported 130°/30 kt and Amini 300°/30 kt. The system lay centred at 1730 hrs IST of 1st near 12.5°N, 73.5°E.

At 2330 hrs IST of 1st, shipJCGI located at 13.4°N, 73.1°E reported a surface wind of 360°/30 kt. Mangalore reported at 2330 hrs IST of 1st strong southeasterly upper winds as given below :

Mangalore	0.3 km	ESE/35 kt
	0.6 km	SE/45 kt
	0.9 km	SE/50 kt

The system was practically stationary till the morning of 2nd. The system moved slowly northwards and lay by 1730 hrs IST of 2nd centred at 13.0°N, 73.5°E. The system moved further northwards and lay near 14°N, 73.5°E at 0830 hrs IST of 3rd. Moving northwest, the system generally weakened into a depression and was centred at 1730 hrs IST near 15°N, 73°E. Thereafter, it moved westnorthwestwards and lay by 0830 hrs IST of 4th near 16°N, 70°E. The depression, thereafter, moved further westnorthwestwards upto 0830 hrs IST of 5th and later weakened into a low pressure area.

This system caused fairly widespread rain or thundershowers in Arabian Sea islands, Kerala and coastal and south Interior Mysore on most days and scattered rain or thundershowers in some parts of Maharashtra and north Interior Mysore on some days during the above period. Alleppey recorded 14 cm of rain and Trivandrum 7 cm on 29th September and Calicut 10 cm and Trivandrum 7 cm on 30th.

11. Depression in the Bay of Bengal - 11th to 12th October.

The seasonal low over the Bay of Bengal was well marked on 10th October both at surface and in the lower troposphere. By the morning of 11th, a depression formed with its centre at 0830 hrs IST near 12.0°N, 86.0°E. The following ships' observations are relevant.

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
PETG	0530	15.9	84.0	1004.7	W	20	-
Desh Bandhu	1130	16.8	82.5	1006.2	NNW	20	-

APT pictures of date reported it as a feeble cyclonic circulation. The associated upper air cyclonic circulation was probably extending to 500 mb.

The depression moved westnorthwestwards and was centred on the evening of the same day near 12.5°N, 85°E. The relevant ships' observations are :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWBK	1730	13.0	82.5	1003.8	NNW	25	
Desh Bandhu	2330	13.9	82.9	1003.3	NNW	25	

By the next morning the depression moved northnorthwestwards and lay centred near 14°N, 84°E.

Though there were no reports of strong winds by ships, the upper air cyclonic circulation was very well marked upto 500 mb with winds of 20-30 kt in circulation at 850 mb. Continuing to move northnorthwestwards, it lay near 15.5°N, 83.5°E by the evening.

It weakened in-situ by the next morning.

12. Depression in the Arabian Sea - 22nd to 24th October.

A well marked low pressure area which developed in southwest Bay of Bengal off south Madras coast on 19th weakened into a low pressure area as it moved across the south Peninsula and lay over Laccadives area by the morning of 20th. Moving westwards it intensified into a depression on the morning of 22nd when it lay centred at 0830 hrs IST near 12.0°N, 68.0°E. ESSA II showed a possible vortex with cirrus outflow to northwest and weak banding. It moved rapidly westnorthwestwards and lay by 1730 hrs IST of 22nd near 12.5°N, 66.5°E. Moving westwards, it lay centred near 12.5°N, 65.5°E on the morning of 23rd. ESSA II showed a cloud patch at 0417 hrs GMT practically with no banding. On the morning of 24th, it was centred near 12.5°N, 60.0°E and by the evening it weakened into a low pressure area.

Under its influence, the following heavy rainfall amounts have been reported in the Arabian Sea Islands :

Minicoy 9 cm and Androth 7 cm on 20th and Amini Divi 7 cm on 21st.

13. Severe cyclonic storm in the Bay of Bengal and the Arabian Sea - 1st to 11th Nov.

A well marked low pressure area lying over south China Sea moved into south Andaman Sea by 31st October. Numbus 2 APT cloud pictures of date showed overcast Cb in the region. ESSA 2 pictures at 0745 hrs IST and Nimbus 2 pictures at 1045 hrs IST on 1st November showed a vortex with overcast diameter about 7 degrees but with overcast mostly to west of centre. The low concentrated into a depression with centre at 0830 hrs IST of 1st near 9°N, 94.5°E. Port Blair at 0530 hrs IST reported ENE/40 kt wind at 850 mb; at 1730 hrs IST, it veered to ESE/45 kt at 850 mb. The system moved rapidly westnorthwestwards and by the morning of 2nd intensified into a cyclonic storm. ESSA 2 pictures at 0810 hrs IST of 2nd and Nimbus 2 pictures at 1155 hrs IST of 2nd. November, showed it as a vortex with centre near 11°N, 87.5°E. There was considerable cirrus outflow to the northwest. The system was centred near 10°N and 88°E at 0830 hrs IST of 2nd. At 0530 hrs IST, a ship of call sign VWTL at 14°N, 85°E reported northnortheasterly wind of 20 kt and pressure 1007.5 mb. At 1030 hrs IST, a ship of call sign VWLG near 12°N, 84.5°E reported a wind of northnortheasterly 35 kt and a pressure 1007.6 mb. Port Blair continued to report eastsoutheasterly wind of 35 kt at 850 mb. The following ships' observations of 1730 hrs IST of 2nd are relevant.

Name of the ship/ call sign	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWLG	1730	12.5	84.5	1012.8	E	35	Overcast
Jala Manjri	1730	12.0	83.5	1007.4	NNE	20	Overcast
GMSN	1730	11.2	82.9	1007.4	NNE	20	Lightning.

The system moving further westnorthwestwards initially, and later northwestwards became a severe cyclonic storm with a core of hurricane winds by the morning of 3rd. ESSA 2 cloud pictures at 0845 hrs IST of 3rd showed it as a vortex with centre near 11.5°N, 82.5°E. Cirrus outflow to northwest was very pronounced. Nimbus 2 pictures at 1125 hrs IST showed the vortex centre at 12.0°N, 81.0°E. The severe cyclonic storm was actually centred at 0830 hrs IST near 12.5°N, 81.0°E. Ship Rajula which passed through the storm centre reported lowest pressure of 961 mb and mountainous seas 15 metres high. Madras upper wind at 0.9 km at 0530 hrs IST of 3rd was northnortheasterly 55 kt. Rajula at 1130 hrs IST near 12.8°N, 80.4°E reported wind eastnortheasterly 60 kt.

Cuddalore at 0830 hrs IST reported westnorthwesterly 25 kt. The crew of Rajula saw on their radar the storm cross the Indian coast near Palar river entrance south of Madras at about 1440 hrs IST. When the barometric pressure as recorded by the ship was 961.0 mb and the maximum wind speed at about this time as recorded by this ship was B.F. 15/17 (95-115 kt).

As per the ESSA -2 pictures at 0845 hrs IST of 3rd, the storm could be classified as Stage X Category 3, with diameter of overcast area of five degrees and the corresponding maximum wind associated with the system works out to 90 kt/hr. However, Ship S.S. Rajula which was very close to the storm recorded the lowest pressure of 961.0 mb on 3rd at 1440 hrs IST and using Fletcher's formula, the maximum wind worked out, comes to about 110 kt. This velocity agrees well with the actual wind experienced by the ship, viz. BF 15-17 (95-115 kt) associated with the system. By the evening it was lying inland as a cyclonic storm centred about 40 km northwest of Cuddalore. Madras wind at 1730 hrs IST was northeasterly 40 kt and Cuddalore was southerly 25 kt. By the morning of 4th, it weakened into a deep depression and lay 120 km southsoutheast of Bangalore. It weakened further into a depression by the evening of 4th and was lying close to Ootacamund. By the morning of 5th it emerged into Arabian Sea and lay over Laccadive region centred near $11^{\circ}N$, $74^{\circ}E$. At 0.9 km a.s.l. Minicoy reported a westerly wind of 25 kt and Goa was easterly 30 kt. ESSA 2 and Nimbus 2 pictures (1015 IST) of date showed overcast Cb in the region. The depression moved west and lay near $11^{\circ}N$, $71.5^{\circ}E$ by the evening. Amini reported at 1730 hrs IST of 5th, a surface wind of westsouthwest 20 knots. The depression moved westwards and lay on the morning (0830 hrs IST) of 6th near $11^{\circ}N$, $71^{\circ}E$. The system intensified into a deep depression during the early hours of 7th. Moving rapidly westwards, it intensified into a cyclonic storm by 0830 hrs IST of 7th when it lay near $11.5^{\circ}N$, $68^{\circ}E$. Satellite ESSA-II at 070345 GMT located the tropical vortex with well marked bandings all around and with considerable cirrus outflow. Satellite Nimbus II indicated the storm centre at 070712 GMT near $12^{\circ}N$ $67^{\circ}E$ with tight bandings in all sectors and a central overcast area of 5° in diameter. Ship PIGO located at 1730 hrs IST of 7th near $14^{\circ}N$, $68.2^{\circ}E$ reported a surface wind of 110/32 kt and another ship GQDL located at $13.5^{\circ}N$, $69^{\circ}E$ reported a surface wind of 110/28 kt. The cyclonic storm further intensified into a severe cyclonic storm and moved further northewest and lay by 0830 hrs IST of 8th near $12.5^{\circ}N$, $66.5^{\circ}E$. Ship VWCG located at $17^{\circ}N$, $64^{\circ}E$, far away from the centre reported a surface wind of 020/36 kt. Satellite ESSA II reported at 080421 GMT the centre at $12.5^{\circ}N$, $66.5^{\circ}E$ with central overcast area of 7° in diameter with tight bandings all around the storm and the eye was seen vide, Fig. 2. ESSA-III at 080839 GMT showed the clear eye of the cyclone near $12.5^{\circ}N$, $65.5^{\circ}E$. A number of ships reported surface winds of 25/35 kt in strength 400 to 500 km away from the centre of the storm. The severe cyclonic storm lay centred at 1730 hrs IST of 8th near $13.0^{\circ}N$, $66.0^{\circ}E$. An aircraft flying between GAN and Bahrein (ETA Bahrein 081045 GMT) reported at 3.6 km a wind 290/45 kt between $9^{\circ}N$, $12^{\circ}N$ sharply veering to 020/50 kt between $12^{\circ}N$ and $13^{\circ}N$. A Boeing aircraft of Air India International on flight from Aden to Bombay (ETA Bombay 082310 GMT) reported at 10 km active thunderstorm belt between $15^{\circ}N$, $60^{\circ}E$ and $17^{\circ}N$, $65^{\circ}E$. The severe cyclonic storm moved westnorthwest and lay near $14^{\circ}N$, $64^{\circ}E$ by 0830 IST of 9th. ESSA-III also showed the eye and external and internal bandings. The storm lay by 0830 hrs IST of 10th near $15.5^{\circ}N$, $61.0^{\circ}E$ Ship Barbara (APMS) located at $16^{\circ}N$, $61.1^{\circ}E$ reported at 0500 GMT of 10th easterly surface wind of force 12 with very rough seas and a low pressure of 965.1 mb. Ship CSBH located at $18.5^{\circ}N$, $56.7^{\circ}E$ reported at 2330 hrs IST of 10th a surface wind of 050/38 kt. ESSA-II at 1000 hrs IST of 11th reported a tropical vortex over $16^{\circ}N$, $58^{\circ}E$. The storm was hence centred at 0830 hrs IST of 11th near $16.0^{\circ}N$, $57.5^{\circ}E$. Ship Nader Waser at 1130 hrs IST located near $16.7^{\circ}N$, $57.2^{\circ}E$ reported a pressure of 987.0 mb and a wind of 070/52 kts. The severe cyclonic storm moved westwards and lay at 1730 hrs IST of 11th near $16.5^{\circ}N$, $56.5^{\circ}E$. A ship located at 1730 hrs IST of 11th near $15.3^{\circ}N$, $56.8^{\circ}E$ reported a surface wind 230/35 kt. The severe cyclonic storm thereafter moved further westwards and crossed Kuria Muria coast and weakened rapidly.

Under the influence of this disturbance, the following heavy rainfalls have been reported : Fort Cochin 8 cm on 5th and Honavar 7 cm on 7th.

The damages caused by this storm at Madras while it crossed Madras coast on the 3rd were :

1. The south quay No. 2 of the Madras Harbour was badly damaged by ships hitting on its walls due to very rough seas.

2. The south quay No. 1 was damaged due to the floating crane (Vaigai) hitting its walls.

3. The asbestos roof of many of the ware houses and godowns at the Harbour were blown off.

4. The railway lines on the south quay were damaged.

5. "Vaigai" the floating crane, got cut off from its anchors, hit the walls of south quay No. 1 of Madras harbour and finally entered the port basin where it could be anchored successfully once again. The crane was also damaged. The total damage to the port was about 4 lakhs.

6. The Panamanian freighter "Progress" (7000 Tonnes) hit against the concrete blocks protecting the south quay, split into two and sank. 18 lives were lost according to the Port Authorities. Two freighters "Marihora" and "Stamatis" were grounded on the south beach adjoining the harbour at about 1445 and 1515 hrs respectively on the same day. All the three ships were anchored in the sea much outside the harbour. Their anchors cut and the ships were drifted ashore.

14. Severe cyclonic storm in the Bay of Bengal and the Arabian Sea 8 - 14 November.

On the morning of 6th November, a low pressure area formed over south Bay of Bengal near $6^{\circ}N$, $89^{\circ}E$. APT cloud picture of date showed overcast Cb clouds in the region By 7th morning the low pressure area shifted slightly westwards and lay over southwest Bay. Nimbus 2 APT cloud pictures of date reported over-cast Cb in the region. By 8th morning it shifted westnorthwestwards, concentrated into a depression and was centred near $8^{\circ}N$, $84^{\circ}E$ at 0830 hrs IST. ESSA 2 APT pictures at 0803 hrs IST showed it as an open circulation. Colombo reported northerly wind of 20 kt at 0.9 km. Nimbus 2 APT cloud pictures at 1210 hrs IST showed more clouding in the region. The following ships' observations are relevant.

Name of the ship	Time IST	Position Lat. $^{\circ}N$	Position Long. $^{\circ}E$	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWBN	1730	8.9	82.7	1001.3	NE	15	-
Rajula	2330	9.8	82.5	1006.2	NNE	35	-

At 1730 hrs IST, the cyclonic circulation was extending to 500 mb. By 9th morning, the depression moved westnorthwestwards, intensified into a cyclonic storm during the night and lay at 0830 hrs IST close to east coast of Ceylon near Trincomalee i.e. near $8.5^{\circ}N$, $81.5^{\circ}E$.

The following observations are relevant :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
Trincomalee	0830			1002.8	NNE	15	-
GMSN	0530	9.6	83.6	1004.8	E	30	-
VWBN	0530	7.3	82.2	1004.4	WSW	25	-

Trincomalee and Batticola reported 15 and 18 cm of rain respectively by 9th morning. ESSA 2 pictures showed Cb over the region with some organisation. Nimbus 2 pictures at 1130 hrs IST showed overcast Cb over ceylon and neighbourhood. By evening, it moved northwestwards, crossed Ceylon and was lying over Palk Strait centred near Mannar. Mannar reported surface wind of southwesterly 45 kt and a pressure of 999.5 mb at 1730 hrs IST of 9th. The storm moved westnorthwestwards crossed Madras coast near Tondi during the night and weakened into a deep depression and was lying 60 km westnorthwest of Madurai on the morning of 10th. ESSA and Nimbus and Nimbus cloud pictures of 10th showed it as a vortex. By the evening it was lying near Coimbatore (11°N, 76.5°E). Moving northwestwards, it was lying about 50 km southeast of Mangalore on 11th morning and was emerging into the Arabian Sea. Nimbus pictures of 11th showed breaks in the overcast. The system emerged into the Arabian Sea during the day and was centred at 1730 hrs IST near 12.5°N, 74.5°E. Amini reported northnorthwesterly surface wind of 30 kt. At 0.9 km Amini reported northwesterly wind of 30 kt and Mangalore southsoutheasterly wind of 30 kt. The system moved northnorthwestwards and intensified into a cyclonic storm which was centred at 0830 hrs IST of 12th near 14°N, 73.5°E. Ship JQMP (Ruyomaru) located at 0830 hrs IST near 13.5°N, 73.5°E reported a surface wind of 290/44 knots with a low pressure of 991.3 mb. The system was of small extent. The coastal stations which were within a degree and a half from the storm centre reported very light winds. The cyclonic storm further intensified into a severe cyclonic storm during the course of the day and was centred at 1730 hrs IST near 14.5°N, 73.0°E. Ship CVLL located at 14.4°N, 72.0°E reported at 2330 hrs IST surface wind of 360/46 kt. It moved northwards and lay by 0830 hrs IST of 13th near 15.5°N, 73°E. Satellite ESSA-II reported a vortex of only 2° diameter with spiral bandings on all sides. An IAC aircraft flying from Cochin to Bombay reported the centre of the cyclone at 1130 hrs IST of 13th close to Goa, with central overcast Cb 80 km around. The system moved further northwards and lay at 1730 hrs IST of 13th close to Ratnagiri. The system crossed south Maharashtra coast near Ratnagiri, during early night of 13th and lay as a depression by 0830 hrs IST of 14th over Madhya Maharashtra about 50 km northnortheast of Ahmadnagar. Moving northeastwards, the depression was centred on the evening of the same day near Akola in Vidarbha. It weakened into a low pressure area over west Madhya Pradesh the next day.

Under the influence of the system, widespread rain was reported in the south Peninsula. The rainfall belt shifted progressively northwards with its northward movement. The following significant amounts of rainfall has been reported in association with the system : Alleppey 18 cm on 10th, Cochin 15 cm on 11th, Goa 12 cm and Panjim (Goa) and Karwar 10 cm each on 13th and Devgad 23 cm, Kolhapur and Ratnagiri 20 cm each and Jeur and Baramati 11 cm each on 14th.

15. Severe cyclonic storm in the Bay of Bengal - 18 to 22 November.

On the morning of 15th November, a fall of pressure with scattered rainfall activity was noticed over the Tennasserim coast and over the Bay Islands indicating that a low pressure area was approaching that area from the east. On the morning of 16th, a pressure rise accompanied with decrease in precipitation was observed over the Tennaserim while the fall of pressure was more over the Bay Islands where the rainfall activity had also increased. The upper winds at 300 m and 600 m over Port Blair had strengthened and veered from northeast to eastnortheast. The above conditions indicated that

a low pressure area had moved westwards into south Andaman Sea. In the same evening a rise of pressure since morning corrected for diurnal variation with decrease in precitation over the Bay Islands suggested that the low pressure area was moving further westwards into the southeast Bay. On the next morning the rise of pressure over the Bay Islands was maintained and the ship of call sign PFLY position 5.9°N, 88.1°E at 0530hrs IST of 17th reported a westnorthwesterly wind of 10 knots and intermittent rain. The above, with the nature of the pressure distribution on the sea level chart indicated that the low pressure area had moved further to the west and lay in the morning of 17th over the southeast Bay of Bengal. In the morning of 18th a cyclonic circulation in the upper air extending upto about 6.0 km a.s.l. developed over the southeast Bay. At 0530 hrs IST of 18th a ship of call sign VWDB at 10.8°N, 83.7°E reported a pressure of 1002.4 mb and a wind northerly 20 kt. APT cloud pictures of ESSA II at 0800 hrs IST showed bright overcast cloud over central Bay with Cirrus outflow to the northwest. By the morning of 18th the low pressure area concentrated into a depression with centre near 10.5°N, 87.0°E. Nimbus II pictures at 1200 hrs IST showed low level circulation centre near 11.0°N, 86.5°E with bright overcast to the west and cirrus outflow. The picture indicated the pre-storm stage. Therefore by this time, the system was probably a deep depression. At 1130 hrs IST, the ship of call sign MAHN, position 5.9°N, 86.3°E reported westerly wind of 20 knots with shower in the previous hour and at 1430 hrs IST, the ship of call sign JWLM position 11°33'N, 84°05'E reported a northeasterly wind of 20 knots and shower and other of call sign FOEH position 5.7°N, 85.1°E, a westerly wind of 20 knots. The deep depression was centred at 1730 hrs IST near 11.0°N, 86.5° E. In this connection the following ships' observations of 18th are worth mentioning:

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWKS	1730	15.7	85.8	1006.5	NNE	25	Overcast sky
VWQF	1730	9.0	89.0	1005.8	W	10	- do -

At 2330 hrs IST, the ship of call sign VWKS position 14.9°N, 85.6°E reported northeasterly wind of 25 knots and intermittent heavy rain. Moving in a northnorthwesterly direction during the course of the night, the deep depression lay centred at 0830 hrs IST of 19th near 14°N, 85°E. The following ships' observations are relevant in this connection :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWHS	0530	14.2	85.2	1001.6	E	25	Overcast sky
VWQG	0530	10.1	86.5	1003.6	W	20	-

At 1130 hrs IST, ship of call sign VWQF position 10.8°N, 85.3°E reported a westerly wind of 28 kt. At 1130 hrs IST a ship Jalamani located at 13.7°N, 85.0°E reported a westnorthwesterly wind of 25 kt. Nimbus 2 cloud picture at 1120 hrs IST showed the circulation centre near 14°N, 85°E. Though the overcast was still mainly west and north, the centre was getting overcast, indicating intensification. The deep depression remained stationary and intensified into cyclonic storm by the same evening. The relevant observations of 19th are given below :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWKS	1730	12.5	84.4	1001.5	NNW	24	Overcast sky
VWDB	1730	14.7	83.5	1000.7	NNE	30	- do -
VWQF	1730	11.4	84.1	1002.0	W	25	Intermittent rain

At 2330 hrs IST, the ship of call sign VWKS position 12.1°N, 84.2°E reported a westnorthwesterly wind of 30 kts with heavy continuous rain. Moving slowly northward and intensifying into a severe cyclonic storm, it lay on the morning of 20th over the west central Bay with its centre at 0830 hrs IST near 14.5°N, 85.0°E. The following ships' observations of 20th are significant in this connection :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWXF	0530	12.5	81.7	1003.9	NW	25	-
VWKS	0530	11.3	83.9	1002.7	W	30	-
PCQU	0530	16.8	89.5	1003.8	ESE	17	Shower in last hour

Winds at 0.9 km along Andhra and Orissa coasts were 30-40 kt. The ship of call sign VWDB position 16.7°N, 83.4°E reported a northeasterly wind of 30 knots at 1730 hrs IST. The weather satellite ESSA-3 photographs showed "tropical vortex at 15°N, 85°E at 1914 GMT of 20th (0044 hrs IST of 21st) central overcast diameter 5°, solid bandings north and west quadrants centre near edge of overcast on picture". It confirmed the storm stage and approximate locality of the disturbance. Moving northwards during the night, the severe cyclonic storm was centred at 0830 hrs IST of 21st near 16.5°N, 85°E. Causing widespread rain with isolated heavy falls over Orissa and adjoining Andhra coast. The following observations are relevant in this connection :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWPR	0530	16.3	83.2	1004.5	NNE	20	Drizzle
VWPR	0830	16.4	83.3	1004.3	N	24	Overcast sky
VWFT	0530	15.6	83.5	1002.7	NNW	5	- do -
PEBU	0530	10.9	87.0	1007.5	WSW	25	Shower
Vishakhapatnam	0830			1006.9	NNW	20	Continuous light rain
Vishakhapatnam	0530	at 3000' a.s.l.			NE	50	

The severe cyclonic storm moved further northwards and lay centred at 1730 hrs IST near 18°N, 85°E. The widespread rain in north Andhra and Orissa coasts continued. Vishakhapatnam recorded a rainfall of 9 cm at 1730 hrs IST of 21st during preceding 9 hours. Moving in a northwesterly direction, the severe cyclonic storm crossed north

Andhra - south Orissa coast near Kalingapatnam during the night of 21st-22nd, weakened and lay as a deep depression on the morning of 22nd over south Orissa and adjoining Madhya Pradesh with its centre at 0830 hrs IST of 22nd about 100 km southeast of Titlagarh. Nimbus 2 pictures at 1130 hrs IST of 22nd showed that the system had still an overcast ares of diameter of 3° around centre. By the next morning, the deep depression weakened further and lay in the morning of 23rd over southeast Madhya Pradesh and adjoining areas of Orissa and Andhra Pradesh as a low pressure area which became unimportant by the same evening.

Under its influence, heavy rains occurred in the coastal Andhra Pradesh and coastal Orissa on 21st and 22nd. Vishakhapatnam recorded a rainfall of 20 cm and Gopalpur 13 cm on 22nd.

16. Severe cyclonic storm in the Bay of Bengal - 25 to 30 November.

On the morning of 23rd November stations in the south Bay Islands, in Malaysia and adjoining Tennasserim reported rain suggesting the approach of a low pressure area to the south Andaman Sea from the east. On the next morning the widespread and heavy rain was reported from stations in the south Bay Islands and the sea level chart indicated that the low pressure area had moved into the south Andaman Sea. By the morning of 25th, the low pressure area had moved slightly to the northwest and concentrated into a depression with centre at 0830 hrs IST of 25th near 10°N, 95°E. During the 24 hrs ending at 0830 hrs IST of 25th, Car Nicobar recorded a very heavy rain of 31 cm and Nancowry 20 cm. The following observations are relevant in this connection. Nimbus 2 APT pictures of date showed overcast Cu-Cb in the area.

Name of the station	Time IST	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
Nancowry	0830	1009.8	WNW	5	-
Car Nicobar	0830	1005.1	W	5	Continuous moderate rain
Port Blair	0830	1010.0	N	10	Continuous light rain

At 0530 hrs IST and at 0.9 km a.s.l., Port Blair reported northerly wind of 30 kt and Victoria Point southerly wind of 10 kt.

Moving westwards during the course of the day, the depression lay centred at 1730 hrs IST near 10°N, 93.5°E. At 1730 hrs IST Port Blair reported an eastnortheasterly wind of 20 kt. On the morning of 26th all the stations in the Bay Islands recorded a rise in pressure indicating that the depression had moved away from the Bay Islands. Nimbus 2 APT pictures at 1100 hrs IST showed the system as a vortex with centre near 11°N, 90°E. No ships' observations were available near the centre. The system had intensified into a deep depression and was probably centred near 10°N, 91.5°E at 0830 hrs IST of 26th. During the next 24 hours, the deep depression moved westnorthwest and rapidly intensified into a cyclonic storm which lay in the morning of 27th over the southwest Bay centred near 11.5°N, 85.5°E as will be evident from the following ships' observations.

1. PFOS (SS Linburg) position 12.2°N, 84.4°E at 0800 hrs IST "App. 12°10'N, 84°25'E experienced wind gale force direction northnortheast, very rough sea. Heavy swell. Bar. 998.8 mb. decreasing. Vis.moderate becoming poor in shower".

2. Same ship PFOS at 1000 hrs IST Position 12.3 °N, 84.3 °E reported "wind near gale force, decreasing, direction eastsoutheast. Sea and swell decreasing Bar. 1002.4 increasing rapidly; last bar reading 991.5 Visibility moderate to good".

3. VWXB at 0700 hrs IST "11.05°N, 83.45°E course 23°. Uncorrected aneroid barometer 1008 mb wind steady north-northwest force 5 to 6. Overcast sky with drizzle".

4. VWXB at 0950 hrs IST "11.30°N, 84.01°E. uncorrected bar reading 1005 mb, barometer unreliable wind west force/and backing quick, heavy rain, very poor visibility". /eight

5. VWFY position 12.0°N, 84.2°E reported at 0530 hrs IST a northeasterly wind of 30 knots and continuous light rain.

At 1130 hrs IST, the ship VWFY position 12.6°N, 84.6°E reported a northeasterly wind of 30 knots and MLTP position 12.4°N, 83.6°E also a northeasterly wind of 30 knots. The weather satellite "ESSA-3 photographs at 1450 hrs IST (0920 hrs GMT) of 27th showed vortex at 12°N, 83.0°E, overcast at 4°. bandings northeast" confirmed the storm stage of the disturbance. Nimbus 2 APT pictures at 1215 hrs IST showed it as a vortex with central overcast about 5° in diameter (edge of picture) and cirrus outflow to the west. Continuing its westnorthwestward movement, the cyclonic storm lay in the same evening centred at 1730 hrs IST near 12°N, 83°E. The following ships' observations of 27th are significant :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
MLTP	1730	11.2	83.6	1003.2	WSW	24	Intermittent rain
GMSN	1730	12.5	80.8	1006.2	NE	26	- do -
VWQF	1730	10.9	81.0	1006.9	N	15	- do -
LMAB	1630	13.0	85.2	1009.7	SSE	18	- do -
VWFY	1730	13.7	84.6	1007.1	E	18	Overcast sky
PFOS	1730	14.1	85.0	1007.2	SE	20	- do -

At 0330 hrs IST of 28th, Ship VISVA KAUSHAL position 13.15°N, 80.40°E reported an easterly wind of 50 knots indicating that by the early hours of 28th, the cyclonic storm had become severe. In the morning, the severe cyclonic storm lay close to north Madras coast centred at 0530 hrs IST near 12.5°N, 80.5°E. Thereafter, it crossed north Madras coast south of Madras, weakened and lay as a cyclonic storm centred at 0830 hrs IST, 50 km south of Madras. Weakening rapidly into a depression by the same evening, it lay over southeast Mysore State and neighbourhood centred at 1730 hrs IST near Bangalore. Moving westnorthwestwards, the depression lay on the morning of 29th with centre at 0830 hrs IST about 100 km southeast of Honavar. Without further change in intensity, the depression moved slowly northnorthwestwards and lay on the morning of 30th over north Mysore coast and adjoining Maharashtra coast with its centre at 0830 hrs IST near Karwar. During the subsequent 24 hrs, the depression moved slightly northnorthwest and weakened into a well marked low pressure area which lay in the morning of 1st December along and off Mysore and south Maharashtra coasts. It weakened further and/ slightly eastwards became unimportant by 3rd. /shifting

Under the influence of the severe cyclonic storm, there was good rainfall activity in the Bay Islands on 24th and 25th in the initial stage and later between 28th

and 30th over the south Peninsula. Some of the noteworthy amounts of rainfall are : Car Nicobar and Nancowry 7 cm each on 24th, Car Nicobar 30 cm and Nancowry 20 cm on 25th, Madras 11 cm on 28th, Bangalore 9 cm, Masulipatam 8 cm, Ongole and Chitradurga 7 cm each on 29th, Honavar 33 cm, Karwar 14 cm, Kakinada, Masulipatam and Vishakhapatnam 8 cm each on 30th.

17. Cyclonic storm in the Bay of Bengal - 7th to 13th December.

On 5th December at 1130 hrs IST and 1730 hrs IST most stations over Malaya region reported rain. At 1730 hrs IST, there was a general fall of pressure over lower Burma, Thailand, Malaya and the Bay Islands, while the pressure was rising further to the east of the area. This indicated that a low pressure system was approaching the Andaman Sea across Malaya. On the morning of 6th rain and thunderstorms were reported by Kondul, Nancowry and Victoria Point. In the same evening all stations in the south Bay Islands reported rain. At 1730 hrs IST of 6th, two ships in the extreme south Bay - one of call sign PEUC (5.6°N, 89.3°E) and the other PCPK (5.8°N, 86.3°E) reported rain indicating that the low pressure area had moved further westwards and lay in the evening of 6th over the extreme south Andaman Sea and adjoining southeast Bay. By the morning of 7th, the rainfall activity over the south Bay Islands increased. Nancowry reported 8 cm of rain during 24 hours ending at 0830 hrs IST of 7th and the pressure was falling over all the Bay Islands and the neighbouring areas. In the general field of negative pressure departures, there was a concentrated negative pressure departure, over the Bay Islands. The above together with the nature of the sea level isobars indicated that the low pressure area had become well marked. Port Blair reported eastnortheasterly wind of 30 kt at 0.9 km. At 1730 hrs IST of the same day, Port Blair recorded a wind speed of 20 knots at 300, 600 and 900 m a.s.l. and 30 knots at 1.5 km and 2 km a.s.l. The following observations showed that the well marked low pressure area concentrated into a depression over the southeast Bay whose centre at 1730 hrs IST of 7th was near 8°N, 88°E.

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
AT E	1730	9.9	92.2	1005.5	SE	20	Continuous heavy rain
VWBY	1730	9.1	92.6	1005.6	SE	20	Overcast sky
Port Blair	1730			1008.7	E	15	Thunderstorm with rain
SPPP	1730	9.1	86.0	1004.1	NE	10	-

Moving northwestwards during the course of the night, the depression lay in the morning of 8th centred at 0830 hrs IST near 9.0°N, 87°E. In this connection, the relevant ships' observations of 8th are given below :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
Soloski (Lumdix)	0530	10.9	88.4	1001.5	ENE	18	Shower
VWBY	0830	8.9	89.5	1007.4	SE	20	Overcast sky

APT cloud pictures showed as a tropical vortex.

At 1130 hrs IST (VCBY) position 8.8°N, 88.8°E reported a westerly wind of 20 knots and intermittent rain. At 1730 hrs IST, the ship of call sign VWZX position 12.9°N 84.3°E at a distance of about 250 km from the centre of the depression reported a east-northeasterly wind of speed 24 knots indicating that the depression had intensified by the evening into a deep depression which lay centred at 1730 hrs IST of 8th near 10.5°N, 86.5°E.

At 0230 hrs IST of 9th, the ship of call sign PCZG position 11.6°N, 87.0°E, when at a distance of about 200 km from the centre of the disturbance reported a east-southeasterly wind of 30 kt. The deep depression moved northnorthwestwards and intensified into a cyclonic storm and lay in the morning of 9th over the southwest Bay of Bengal centred at 0830 hrs IST near 11.5°N, 85.5°E. The relevant ships' observations are given below :

Name of the ship/ station	Time IST	Position		Pressure (mb)	Wind		Weather
		Lat. °N	Long. °E		Direction	Speed knots	
VWSG	0530	13.3	84.8	1004.3	NE	24	Continuous heavy rain
VWXZ	0530	14.0	84.2	1005.3	NE	24	Overcast sky
VWXW	0830	13.5	83.4	1010.5	NE	30	Drizzle with light rain
VWPS	0530	11.3	87.2	1000.5	S	30	Overcast

The satellite ESSA-3 photographs showed "a tropical vortex located near 13.0°N 84.0°E at 0757 GMT (1327 hrs IST) of 9th with circular diameter 4° and bright overcast extending eastwards to 90°E and northeastwards to 18°N, 87°E" and confirmed the storm stage of the disturbance. Moving in a northerly direction during the day, the cyclonic storm lay in the evening centred at 1730 hrs IST of 9th near 12.5°N, 85.5°E. The relevant observations are given below :

Name of the ship/ station	Time IST	Position		Pressure (mb)	Wind		Weather
		Lat. °N	Long. °E		Direction	Speed knots	
London Tradition-MXYE	1730	11.4	85.3	-	W	30	Squall
VWSG	1730	14.5	85.4	1002.5	NNE	34	-
VWZX	1730	14.0	84.2	1005.3	NE	24	-

At 2030 hrs IST also London Tradition position 11.9°N, 85.6°E reported a west-southwesterly wind of 30 knots. VWSG at 2330 hrs IST, position 15°N, 85.7°E reported a northnortheasterly wind of 30 knots and at 0230 hrs IST of 10th VWPS reported a northerly wind of 30 kt with squall. The cyclonic storm moving in a northnorthwesterly direction without further appreciable intensification, lay in the morning of 10th over the west central Bay of Bengal centred at 0830 hrs IST near 14°N, 85.0°E. The following ships' observations are significant in this connection:

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWSG	0530	15.5	85.8	1004.3	NNE	34	Continuous moderate rain
VWPS	0530	13.5	84.0	1001.4	N	25	Shower in the last hour
VWPS	0830	13.3	83.5	1005.4	NNW	27	- do -

At 1130 hrs IST VWPS position 16.6°N, 84.5°E reported a northeasterly wind of 30 knots and drizzle in last hour and VWSG position 15.6°N, 84.7°E reported a northeasterly wind of 29 knots. The weather satellite 3 photographs showed "vortex at 14°N, 85°E at 0850 GMT (1420 hrs IST) of 10th December central overcast diameter 3°. Spiral bandings all quadrants" indicating that the disturbance was still in the storm stage. At 1030 hrs IST, a ship at 14.1°N, 85.2°E reported southerly wind of 35 kt. During the course of the day, the cyclonic storm moved northwards and lay in the evening centred at 1730 hrs IST near 15°N, 85°E. Significant observations in this connection are given below :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
Border Tarvior	1730	14.2	85.5	994.8	SSW	35	Shower
Boles Land	1730	11.6	83.0	1008.0	NW	30	Intermittent rain
VWSG	1730	17.2	85.5	1006.1	NNE	28	Overcast sky
Sateera	1515	14.3	86.1	1007.0	SE	8 BF	Rough sea, Heavy swell and frequent rain-squall

Recurving northeastwards, the cyclonic storm was centred at 0830 hrs IST of 11th near 15.5°N, 85.5°E. Weather satellite Nimbus 2 time 0630 GMT (1200 hrs IST) of 11th showed Tropical Vortex near 16°N, 86°E, central overcast five degrees diameter banding all sectors" confirmed the location of the cyclonic storm. There was extension of weather to the northeast. Stations in East Pakistan coast and Arakan coast started raining. Moving further northeastwards, it was centred at 1730 hrs IST of 11th near 17°N, 87°E. Continuing its northeastward movement rather rapidly, it lay in the morning of 12th over the north Bay centred at 0830 hrs IST near 19.5°N and 89.5°E. The following observations are worth mentioning in this connection :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWBD	0530	20.9	88.2	1004.3	NE	33	Continuous heavy rain
Sandheads	0830			1005.9	NNE	40	Continuous rain

Continuing to move in the same direction, the cyclonic storm was centred at 1730 hrs IST near 21°N, 91°E and crossed East Pakistan coast between Cox's Bazar and

Chittagong during the night of 12-13th and broke up against the southeast Assam-Burma hills by the next morning.

Under its influence, there was good rainfall activity over the Bay Islands in the initial stage and in Gangetic West Bengal and Assam later. Nancowry recorded a rainfall of 8 cm on 7th, Mayabandar 8 cm on 10th and Imphal 9 cm on 13th.

18. Deep depression in the Bay of Bengal - 16 to 19 December.

The positions and intensity of this system are mainly based on satellite cloud pictures as the coverage of ship data near the centre was poor in the initial stages.

On the morning of 14th December, associated with widespread precipitation in the Bay Islands and well marked field of negative pressure departures, a low pressure area formed over the south Andaman Sea and the adjoining southeast Bay. On the morning of 15th, widespread rain over the Bay Islands continued and fall of pressure was observed at most stations in the Bay Islands and a rise of pressure over the Tennasserim coast. The pressure departures which were below normal over the entire country were appreciably so over the Bay Islands. The above facts together with the nature of the isobars on the sea level chart showed that the low pressure area had moved westward and lay in the morning of 15th over the southeast Bay and adjoining Andaman Sea and was well marked. The weather Satellite ESSA-3 photographs at 0716 GMT (1246 hrs IST) of 15th showed a tropical vortex near 10°N, 91.5°E with central bright overcast approximately 4° in diameter cirrus outflow from northern quadrants. On the morning of 16th, the low concentrated into a depression and was centred at 0830 hrs IST near 8°N, 90°E. At 0530 hrs IST ship VWVX at position 11.0°N, 90.2°E reported wind NE/15 kt. Another ship YTQO at 8.5°N,90.2°E reported wind E/5 kt. At 1130 hrs IST, the ship of call sign MCLD position 12.8°N, 86.3°E reported a northnortheasterly wind of 18 knots and shower. Three closed isobars could be drawn around the system. Weather Satellite ESSA-3 photographs at 0807 GMT (1337 hrs IST) of 16th showed "a vortex at 11°N, 89°E circulation on edge of overcast mostly north and west of centre, some banding existent". Moving westnorthwestwards, the depression lay in the morning of 17th centred at 0830 hrs IST near 9°N, 87.5°E. Nimbus 2 APT pictures at 1140 hrs IST showed it was a vortex with more clouding to the north and also cirrus outflow to north. The relevant ships' observations in this connection are given below :

Name of the ship/ station	Time IST	Position		Pressure (mb)	Wind		Weather
		Lat. °N	Long. °E		Direction	Speed knots	
AQLE	0530	10.0	83.2	1007.4	NE	18	-
VWKS	0530	7.6	82.6	1007.8	N	13	Continuous moderate rain
FNML	0530	6.0	83.0	1007.0	WNW	16	Overcast sky,squall
PFNH	0530	5.7	87.2	1006.5	SW	13	-
GMSN	0530	6.8	92.6	1007.6	S	09	-
SCKF	0530	5.8	90.6	1010.6	SSW	12	-

Moving westwards and intensifying into a deep depression, it lay on the morning of 18th with its centre at 0830 hrs IST near 9.5°N, 86.0°E. Nimbus 2 APT pictures at 1107 IST showed that the system had considerably weakened as there was no overcast and only cumulus banding was there. However, winds in circulation were of about the same strength. The following ships' observations of 18th are worth mentioning, in this connection:

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWKS	0530	10.4	83.8	1006.9	N	18	-
AQAH	0530	13.2	86.3	1007.5	E	18	-
GMSN	0530	8.6	88.3	1006.5	S	5	Shower in last hour
GJFG	0830	9.7	88.8	1008.9	SE	15	- do -

The deep depression, thereafter moved northwest and lay in the same evening over the southwest Bay with its centre at 1730 hrs IST near 10.5°N,85.0°E. The following observations of 18th are significant in this connection :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VW S	1730	10.5	84.4	1003.0	N	24	Intermittent rain
DEAZ	1730	12.0	87.2	1003.8	ESE	18	- do -
VWFT	1730	13.5	86.2	1009.1	E	12	Overcast sky

The deep depression remained practically stationary till the morning of 19th. The relevant ships' observations are given below :

Name of the ship/ station	Time IST	Position Lat. °N	Position Long. °E	Pressure (mb)	Wind Direction	Wind Speed knots	Weather
VWKS	0530	11.8	85.0	1007.3	ENE	30	Heavy rain
VWDG	0530	13.1	82.8	1004.4	NNE	18	-
VWDG	0830	13.1	83.4	1008.1	ENE	17	Overcast sky
GQDL	0530	12.9	82.8	1006.4	NNE	18	Drizzle
GMSN	0530	9.5	84.0	1006.0	W	5	-

Thereafter it moved westwards and was lying at 1730 hrs IST near 10.5°N,83.5°E. Later it weakened into a low off extreme south Peninsula. The low pressure area finally moved away westwards across Maldives by 21st.

Under its influence, the Bay Islands received good rainfall on 15th and 16th and Madras State on 20th and 21st. Noteworthy amounts of rainfall are : Long Island 5 cm each on 15th and 16th, Port Blair 6 cm on 16th, Cuddalore 13 cm,Madras 8 cm, Kallakkurichchi 6 cm on 20th and Kodaikanal 5 cm on 21st.

According to press reports, heavy rain caused disruption of air traffic services in Madras.

TABLE II

Monthly distribution of cyclonic storms and depressions in the Bay of Bengal and Arabian Sea

1966

Month	Jan.		Feb.		Mar.		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total	
Disturbance	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C
Bay of Bengal								1(1)	1		3		2				1	1(1)	1		4(3)		1	1	9	7(5)
Arabian Sea																		1		1		2(2)			1	3(2)
Total								1(1)	1		3		2				1	2(1)	2		6(5)		1	1	10	10(7)

D - Depression
C - Cyclonic storm
Figures in brackets indicate severe cyclonic storm.

TRACKS OF STORMS AND DEPRESSIONS

(IN THE INDIAN SEAS)

1966

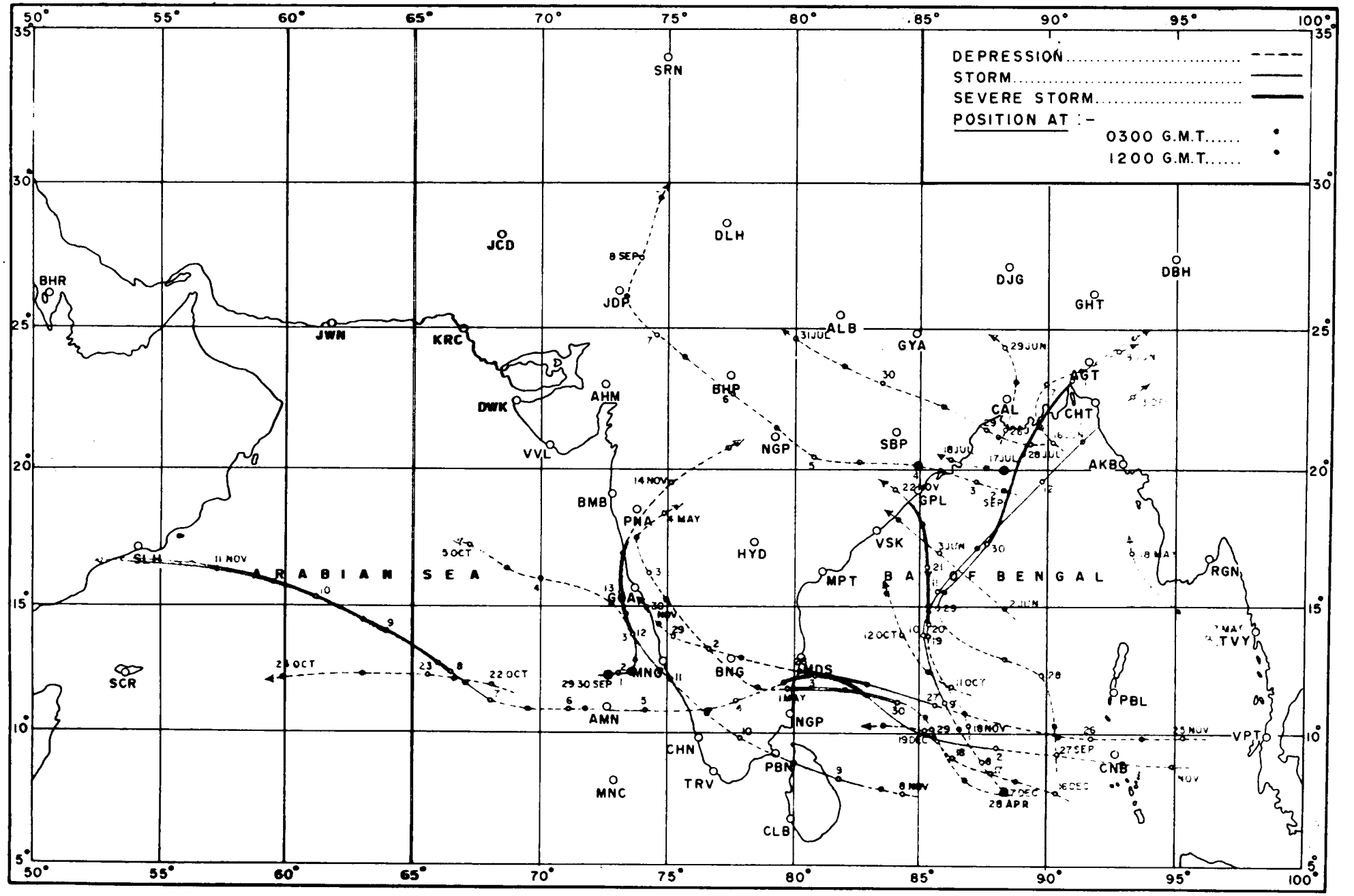

FIG. 1

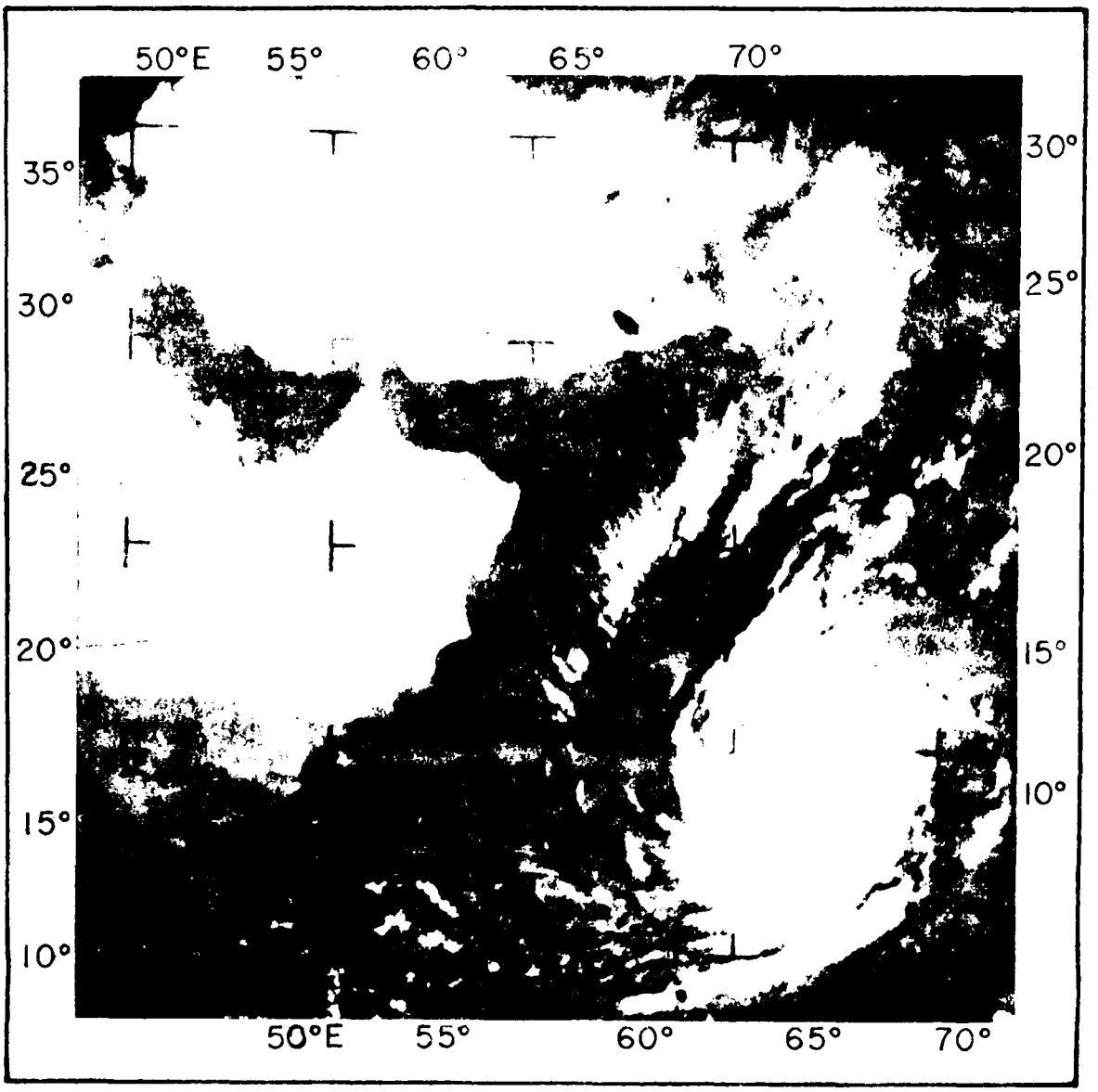

FIG. 2 : ESSA II : 8 NOVEMBER 1966, ORBIT 3204 (0951 HRS IST.)